DRL60-1

RELIABILITY DATA

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※ Test results are typical data. Nevertheless the following results are considered to be actual capability data because all units have nearly the same characteristics.

1. Calculated Values of MTBF

MODEL : DRL60-24-1

(1) Calculating Method

Calculated based on stress reliability projection of Telcordia SR-332 issue3.
Individual failure rates FR is given to each part and MTBF is calculated
by the count of each part.(Method I)

$$MTBF = \frac{1}{FR_{equip}} = \frac{1}{\sum_{i=1}^{n} n_i \left(L_G \times \pi_Q \times \pi_S \times \pi_T \times \pi_E \times \pi_{CF}\right)_i} \times 10^9 \quad \text{Hours}$$

FR_{equip} : Total Equipment Failure Rate (Failure／10^9Hours)

L_G : Mean generic (or base) failure rate.

n_i : Quantity of ith Generic Part

n : Number of Different Generic Part Categories

π_Q : Quality factor, which depends on the part's quality level.

π_S : Stress factor, which depends on the part's stress level.

π_T : Temperature factor, which depends on the part's operating temperature.

π_E : Environment factor, which depends on the circuit's operating environment.

π_{CF} : Correction Factor, which depends on the part's correction factor.

(2) MTBF Values

Condition:

G_F : Ground, Fixed — Ambient Temperature: 55℃

Model Type: Serial — UCL(upper confidence level): 90%

Io=100% load — Quality Level: II

Vin: 115Vac : MTBF ≒ 363430 (hours)

Vin: 230Vac : MTBF ≒ 369824 (hours)

2. Components Derating

MODEL：DRL60-1

(1) Calculating Method

(a) Measuring method

Mounting method ：Standard mounting	Ambient temperature：55℃
Input voltage : 115, 230VAC	Output voltage & current : 100%

(b) Semiconductors

Compared with maximum junction temperature and actual one which is calculated based on case temperature, power dissipation and thermal impedance.

(c) IC, Resistors, Capacitors, etc.

Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

(d) Calculating method of thermal impedance

$$\theta j-c = \frac{Tj(max) - Tc}{Pd(max)} \qquad \theta j-a = \frac{Tj(max) - Ta}{Pd(max)} \qquad \theta j-l = \frac{Tj(max) - Tl}{Pd(max)}$$

Tc : Case Temperature at Start Point of Derating；25℃ in General

Ta : Ambient Temperature at Start Point of Derating；25℃ in General

Tl : Lead Temperature at Start Point of Derating；25℃ in General

Pd(max) : Maximum Power Dissipation

Tj(max) (Tch(max)) : Maximum Junction (channel) Temperature

θj-c (θch-c) : Thermal Impedance between Junction (channel) and Case

θj-a : Thermal Impedance between Junction and air

θj-l : Thermal Impedance between Junction and Lead

(2) Component Derating List

Model: DRL60-12-1

Location No.	Vin = 115VAC Ta = 55℃ Load = 100%(Vo: 12V, Io: 4.5A)		
A101 L6566BTR ST MICRO.	Tj (max) = 150 ℃ Pd = 214.5 mW Tj= Tc+ ((θj-a)× Pd) =109.9℃ D.F. = 73.29%	θj-a = 120.0 ℃/W ΔTc= 29.2℃	Pd (max) = 0.75 W Tc= 84.2 ℃
A201 TL432AIPK TI	Tj (max) = 150 ℃ Pd = 6.4 mW Tj= Tc+ ((θj-a)× Pd) =83.5℃ D.F. = 55.64%	θj-c = 9.0 ℃/W ΔTc= 28.4℃	 Tc= 83.4 ℃
Q1 IPA60R199CP INFINEON	Tch (max) = 150 ℃ Pd = 1.28 W Tch= Tc+ ((θch-c)× Pd) =109.7℃ D.F. = 73.16%	θch-c = 3.7 ℃/W ΔTc= 50.0℃	Pd (max) = 34.0 W Tc= 105.0 ℃
D1 GBL206 LITE ON	Tj (max) = 150 ℃ Pd = 1.6 W Tj= Tc+ ((θj-c)× Pd) =113.0℃ D.F. = 75.33%	θj-c = 8.0 ℃/W ΔTc= 45.2℃	 Tc= 100.2 ℃
D51 STPS20H100CFP ST MICRO.	Tj (max) = 175 ℃ Pd = 2.1 W Tj= Tc+ ((θj-c)× Pd) =134.5℃ D.F. = 76.87%	θj-c = 3.2 ℃/W ΔTc= 72.8℃	 Tc= 127.8 ℃
D101 D1F60-5053 SHINDENGEN	Tj (max) = 150 ℃ Pd = 100.0 mW Tj= Tl+ ((θj-l)× Pd) =113.7℃ D.F. = 75.8%	θj-l = 23.0 ℃/W ΔTl= 56.4℃	 Tl= 111.4 ℃
D103 CRH01(TE85L,Q) TOSHIBA	Tj (max) = 150 ℃ Pd = 12.7 mW Tj= Tc+ ((θj-a)× Pd) =95.8℃ D.F. = 63.83%	θj-a = 130.0 ℃/W ΔTc= 39.1℃	 Tc= 94.1 ℃
PC101 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.71 mW Tj= Tc+ ((θj-a)× Pd) =81.5℃ D.F. = 65.18%	θj-a = 666.7 ℃/W ΔTc= 26.0℃	Pd (max) = 150.0 mW Tc= 81.0 ℃
PC101 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.83 mW Tj= Tc+ ((θj-a)× Pd) =81.3℃ D.F. = 65.02%	θj-a = 333.3 ℃/W ΔTc= 26.0℃	Pd (max) = 100.0 mW Tc= 81.0 ℃
PC102 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj= Tc+ ((θj-a)× Pd) =79.3℃ D.F. = 63.44%	θj-a = 666.7 ℃/W ΔTc= 24.3℃	Pd (max) = 150.0 mW Tc= 79.3 ℃
PC102 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj= Tc+ ((θj-a)× Pd) =79.3℃ D.F. = 63.44%	θj-a = 333.3 ℃/W ΔTc= 24.3℃	Pd (max) = 100.0 mW Tc= 79.3 ℃

(2) Component Derating List

Model: DRL60-12-1

Location No.	Vin = 230VAC Ta = 55℃ Load = 100%(Vo: 12V, Io: 4.5A)		
A101 L6566BTR ST MICRO.	Tj (max) = 150 ℃ Pd = 205.7 mW Tj= Tc+ ((θj-a)× Pd) =108.0℃ D.F. = 71.99%	θj-a = 120.0 ℃/W ΔTc= 28.3℃	Pd (max) = 0.75 W Tc= 83.3 ℃
A201 TL432AIPK TI	Tj (max) = 150 ℃ Pd = 6.3 mW Tj= Tc+ ((θj-a)× Pd) =83.7℃ D.F. = 55.77%	θj-c = 9.0 ℃/W ΔTc= 28.6℃	Tc= 83.6 ℃
Q1 IPA60R199CP INFINEON	Tch (max) = 150 ℃ Pd = 1.58 W Tch= Tc+ ((θch-c)× Pd) =111.3℃ D.F. = 74.23%	θch-c = 3.7 ℃/W ΔTc= 50.5℃	Pd (max) = 34.0 W Tc= 105.5 ℃
D1 GBL206 LITE ON	Tj (max) = 150 ℃ Pd = 0.9 W Tj= Tc+ ((θj-c)× Pd) =91.9℃ D.F. = 61.27%	θj-c = 8.0 ℃/W ΔTc= 29.7℃	Tc= 84.7 ℃
D51 STPS20H100CFP ST MICRO.	Tj (max) = 175 ℃ Pd = 2.0 W Tj= Tc+ ((θj-c)× Pd) =135.1℃ D.F. = 77.2%	θj-c = 3.2 ℃/W ΔTc= 73.7℃	Tc= 128.7 ℃
D101 D1F60-5053 SHINDENGEN	Tj (max) = 150 ℃ Pd = 100.0 mW Tj= Tl+ ((θj-l)× Pd) =110.9℃ D.F. = 73.93%	θj-l = 23.0 ℃/W ΔTl= 53.6℃	Tl= 108.6 ℃
D103 CRH01(TE85L,Q) TOSHIBA	Tj (max) = 150 ℃ Pd = 10.8 mW Tj= Tc+ ((θj-a)× Pd) =92.3℃ D.F. = 61.54%	θj-a = 130.0 ℃/W ΔTc= 35.9℃	Tc= 90.9 ℃
PC101 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 1.0 mW Tj= Tc+ ((θj-a)× Pd) =81.4℃ D.F. = 65.09%	θj-a = 666.7 ℃/W ΔTc= 25.7℃	Pd (max) = 150.0 mW Tc= 80.7 ℃
PC101 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.83 mW Tj= Tc+ ((θj-a)× Pd) =81.0℃ D.F. = 64.78%	θj-a = 333.3 ℃/W ΔTc= 25.7℃	Pd (max) = 100.0 mW Tc= 80.7 ℃
PC102 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj= Tc+ ((θj-a)× Pd) =79.0℃ D.F. = 63.2%	θj-a = 666.7 ℃/W ΔTc= 24.0℃	Pd (max) = 150.0 mW Tc= 79.0 ℃
PC102 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj= Tc+ ((θj-a)× Pd) =79.0℃ D.F. = 63.2%	θj-a = 333.3 ℃/W ΔTc= 24.0℃	Pd (max) = 100.0 mW Tc= 79.0 ℃

(2) Component Derating List

Model: DRL60-24-1

Location No.	Vin = 115VAC Ta = 55℃ Load = 100%(Vo: 24V, Io: 2.5A)		
A101 L6566BTR ST MICRO.	Tj (max) = 150 ℃ Pd = 204.0 mW Tj= Tc+ ((θj-a)× Pd) =107.6℃ D.F. = 71.72%	θj-a = 120.0 ℃/W ΔTc= 28.1℃	Pd (max) = 0.75 W Tc= 83.1 ℃
A201 TL432AIPK TI	Tj (max) = 150 ℃ Pd = 26.3 mW Tj= Tc+ ((θj-a)× Pd) =84.8℃ D.F. = 56.56%	θj-c = 9.0 ℃/W ΔTc= 29.6℃	Tc= 84.6 ℃
Q1 IPA60R199CP INFINEON	Tch (max) = 150 ℃ Pd = 1.55 W Tch= Tc+ ((θch-c)× Pd) =117.6℃ D.F. = 78.42%	θch-c = 3.7 ℃/W ΔTc= 56.9℃	Pd (max) = 34.0 W Tc= 111.9 ℃
D1 GBL206 LITE ON	Tj (max) = 150 ℃ Pd = 0.9 W Tj= Tc+ ((θj-c)× Pd) =108.0℃ D.F. = 72.%	θj-c = 8.0 ℃/W ΔTc= 45.8℃	Tc= 100.8 ℃
D51 STPS20170CFP STMICRO	Tj (max) = 175 ℃ Pd = 2.2 W Tj= Tc+ ((θj-c)× Pd) =119.8℃ D.F. = 68.46%	θj-c = 3.5 ℃/W ΔTc= 57.1℃	Tc= 112.1 ℃
D101 D1F60-5053 SHINDENGEN	Tj (max) = 150 ℃ Pd = 48.9 mW Tj= Tl+ ((θj-l)× Pd) =95.8℃ D.F. = 63.88%	θj-l = 23.0 ℃/W ΔTl= 39.7℃	Tl= 94.7 ℃
D103 CRH01(TE85L,Q) TOSHIBA	Tj (max) = 150 ℃ Pd = 12.7 mW Tj= Tc+ ((θj-a)× Pd) =95.8℃ D.F. = 63.83%	θj-a = 130.0 ℃/W ΔTc= 39.1℃	Tc= 94.1 ℃
PC101 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 2.34 mW Tj= Tc+ ((θj-a)× Pd) =84.8℃ D.F. = 67.81%	θj-a = 666.7 ℃/W ΔTc= 28.2℃	Pd (max) = 150.0 mW Tc= 83.2 ℃
PC101 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 1.0 mW Tj= Tc+ ((θj-a)× Pd) =83.5℃ D.F. = 66.83%	θj-a = 333.3 ℃/W ΔTc= 28.2℃	Pd (max) = 100.0 mW Tc= 83.2 ℃
PC102 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj= Tc+ ((θj-a)× Pd) =83.2℃ D.F. = 66.56%	θj-a = 666.7 ℃/W ΔTc= 28.2℃	Pd (max) = 150.0 mW Tc= 83.2 ℃
PC102 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj= Tc+ ((θj-a)× Pd) =83.2℃ D.F. = 66.56%	θj-a = 333.3 ℃/W ΔTc= 28.2℃	Pd (max) = 100.0 mW Tc= 83.2 ℃

(2) Component Derating List

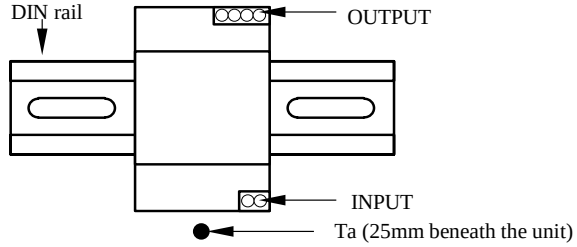
Model: DRL60-24-1

Location No.	Vin = 230VAC Ta = 55℃ Load = 100%(Vo: 24V, Io: 2.5A)		
A101 L6566BTR ST MICRO.	Tj (max) = 150 ℃ Pd = 204.0 mW Tj= Tc+ ((θj-a)× Pd) =107.6℃ D.F. = 71.72%	θj-a = 120.0 ℃/W ΔTc= 28.1℃	Pd (max) = 0.75 W Tc= 83.1 ℃
A201 TL432AIPK TI	Tj (max) = 150 ℃ Pd = 26.3 mW Tj= Tc+ ((θj-a)× Pd) =84.1℃ D.F. = 56.09%	θj-c = 9.0 ℃/W ΔTc= 28.9℃	 Tc= 83.9 ℃
Q1 IPA60R199CP INFINEON	Tch (max) = 150 ℃ Pd = 1.0 W Tch= Tc+ ((θch-c)× Pd) =120.6℃ D.F. = 80.4%	θch-c = 3.7 ℃/W ΔTc= 61.9℃	Pd (max) = 34.0 W Tc= 116.9 ℃
D1 GBL206 LITE ON	Tj (max) = 150 ℃ Pd = 0.5 W Tj= Tc+ ((θj-c)× Pd) =87.9℃ D.F. = 58.6%	θj-c = 8.0 ℃/W ΔTc= 28.9℃	 Tc= 83.9 ℃
D51 STPS20170CFP STMICRO	Tj (max) = 175 ℃ Pd = 2.2 W Tj= Tc+ ((θj-c)× Pd) =119.8℃ D.F. = 68.46%	θj-c = 3.5 ℃/W ΔTc= 57.1℃	 Tc= 112.1 ℃
D101 D1F60-5053 SHINDENGEN	Tj (max) = 150 ℃ Pd = 56.2 mW Tj= Tl+ ((θj-l)× Pd) =93.0℃ D.F. = 62.%	θj-l = 23.0 ℃/W ΔTl= 36.7℃	 Tl= 91.7 ℃
D103 CRH01(TE85L,Q) TOSHIBA	Tj (max) = 150 ℃ Pd = 10.8 mW Tj= Tc+ ((θj-a)× Pd) =92.3℃ D.F. = 61.54%	θj-a = 130.0 ℃/W ΔTc= 35.9℃	 Tc= 90.9 ℃
PC101 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 2.16 mW Tj= Tc+ ((θj-a)× Pd) =83.7℃ D.F. = 66.99%	θj-a = 666.7 ℃/W ΔTc= 27.3℃	Pd (max) = 150.0 mW Tc= 82.3 ℃
PC101 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 1.0 mW Tj= Tc+ ((θj-a)× Pd) =82.6℃ D.F. = 66.11%	θj-a = 333.3 ℃/W ΔTc= 27.3℃	Pd (max) = 100.0 mW Tc= 82.3 ℃
PC102 TLP291(GR,SE (TRANSISTOR) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.94 mW Tj= Tc+ ((θj-a)× Pd) =82.9℃ D.F. = 66.34%	θj-a = 666.7 ℃/W ΔTc= 27.3℃	Pd (max) = 150.0 mW Tc= 82.3 ℃
PC102 TLP291(GR,SE (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 1.36 mW Tj= Tc+ ((θj-a)× Pd) =82.8℃ D.F. = 66.2%	θj-a = 333.3 ℃/W ΔTc= 27.3℃	Pd (max) = 100.0 mW Tc= 82.3 ℃

3. Main Components Temperature Rise △T List

MODEL : DRL60-1

(1) Measuring Conditions

Mounting Method (Standard Mounting)	Standard Mounting 	
Input voltage (Vin)	115VAC	
Output voltage (Vo)	12VDC	24VDC
Output current (Io)	4.5A(100%)	2.5A(100%)

(2) Measuring Results

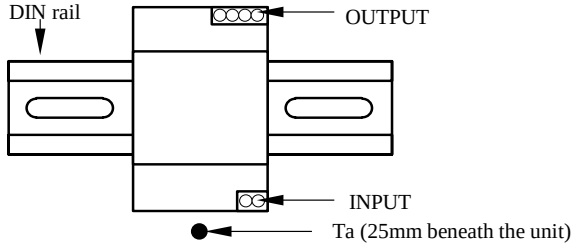
Output Derating		ΔT Temperature Rise (℃) Io=100 % Ta=55℃	
Location No.	Part name	Standard Mounting	
		12VDC	24VDC
A101	IC	29.2	28.1
A201	CHIP IC	28.4	29.6
C2	E.CAP.	30.4	33.5
C3	E.CAP.	31.2	33
C5	E.CAP.	25.6	31.4
C51	E.CAP.	51.1	43.9
C52	E.CAP.	52.2	43.1
C54	E.CAP.	38.7	34.8
D1	BRIDGE DIODE	45.2	45.8
D51	S.B.D	72.8	56.9
L1	BALUN COIL	39.4	37.9
L2	BALUN COIL	34	37.3
L52	CHOKE COIL	52.5	-
L55	CHOKE COIL	-	43.4
PC101	PHOTO COUPLER	26	28.2
PC102	PHOTO COUPLER	24.3	28.2
Q1	MOSFET	50	56.9
T1	TRANSFORMER	50.8	49

- : Parts do not exist.

3. Main Components Temperature Rise △T List

MODEL : DRL60-1

(1) Measuring Conditions

Mounting Method (Standard Mounting)	Standard Mounting 	
Input voltage (Vin)	230VAC	
Output voltage (Vo)	12VDC	24VDC
Output current (Io)	4.5A(100%)	2.5A(100%)

(2) Measuring Results

Output Derating		ΔT Temperature Rise (℃) Io=100 % Ta=55℃	
Location No.	Part name	Standard Mounting	
		12VDC	24VDC
A101	IC	28.3	28.1
A201	CHIP IC	28.6	28.9
C2	E.CAP.	26.4	27.1
C3	E.CAP.	27.5	26.8
C5	E.CAP.	25.3	27.4
C51	E.CAP.	52.5	44.5
C52	E.CAP.	53.4	43.5
C54	E.CAP.	39.4	34.6
D1	BRIDGE DIODE	29.7	28.9
D51	S.B.D	73.7	57.1
L1	BALUN COIL	25.5	23
L2	BALUN COIL	21.7	22.5
L52	CHOKE COIL	53.5	-
L55	CHOKE COIL	-	43.7
PC101	PHOTO COUPLER	25.7	27.3
PC102	PHOTO COUPLER	24	27.3
Q1	MOSFET	50.5	61.9
T1	TRANSFORMER	55.5	52.2

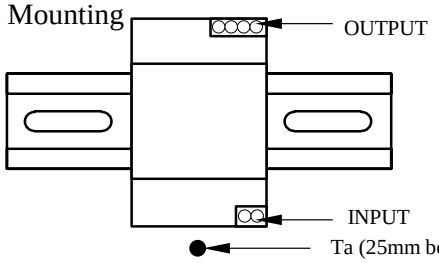
- : Parts do not exist.

4. Electrolytic Capacitor Lifetime

MODEL : DRL60-12-1

Cooling condition : Convection cooling

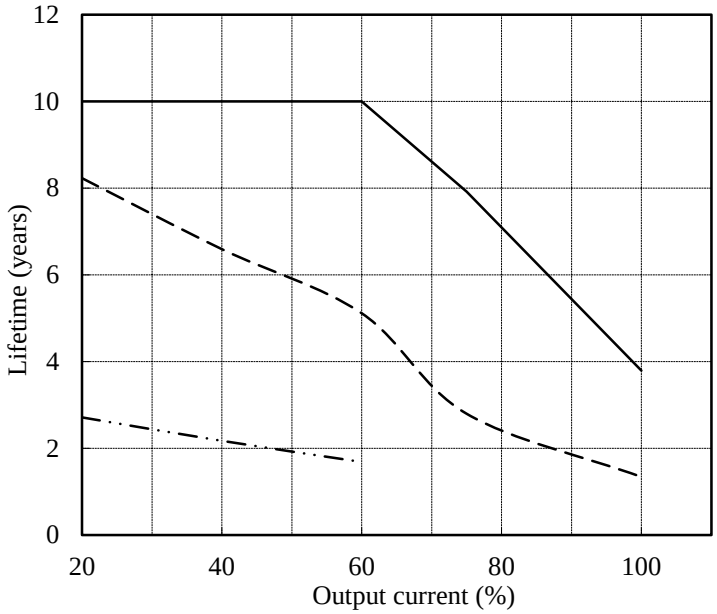
Standard Mounting



Conditions Ta 40℃ : ——
55℃ : – – –
71℃ : —··—

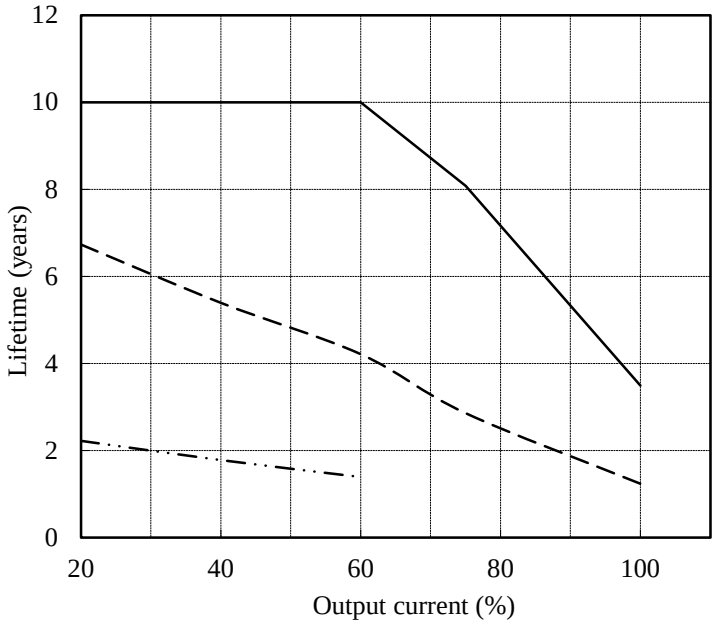
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 55℃	Ta= 71℃
20	10.0	8.2	2.7
40	10.0	6.6	2.2
60	10.0	5.1	1.7
75	7.9	2.8	-
100	3.8	1.3	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 55℃	Ta= 71℃
20	10.0	6.7	2.2
40	10.0	5.4	1.8
60	10.0	4.2	1.4
75	8.1	2.9	-
100	3.5	1.2	-

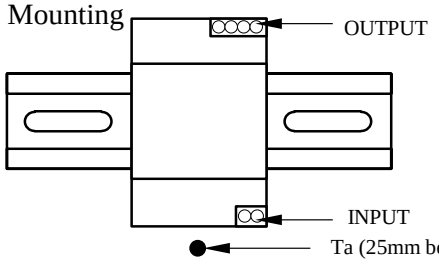


4. Electrolytic Capacitor Lifetime

MODEL : DRL60-24-1

Cooling condition : Convection cooling

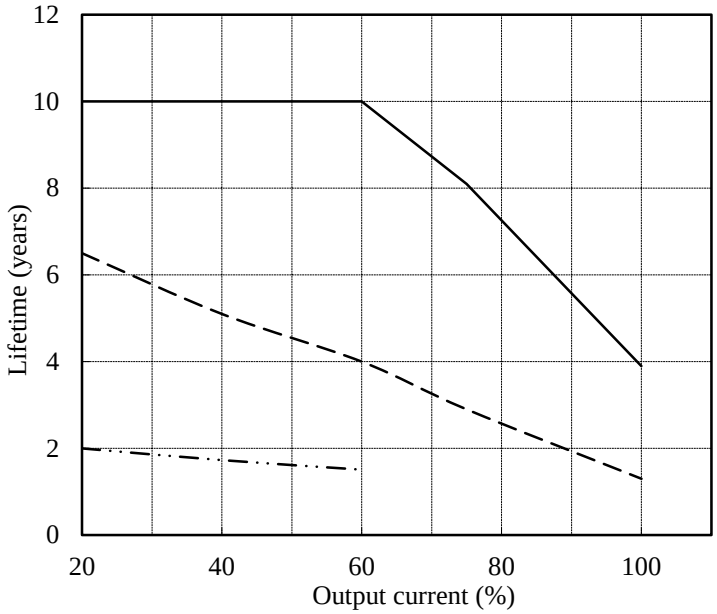
Standard Mounting



Conditions Ta 40℃ : ——
55℃ : – – –
71℃ : —··—

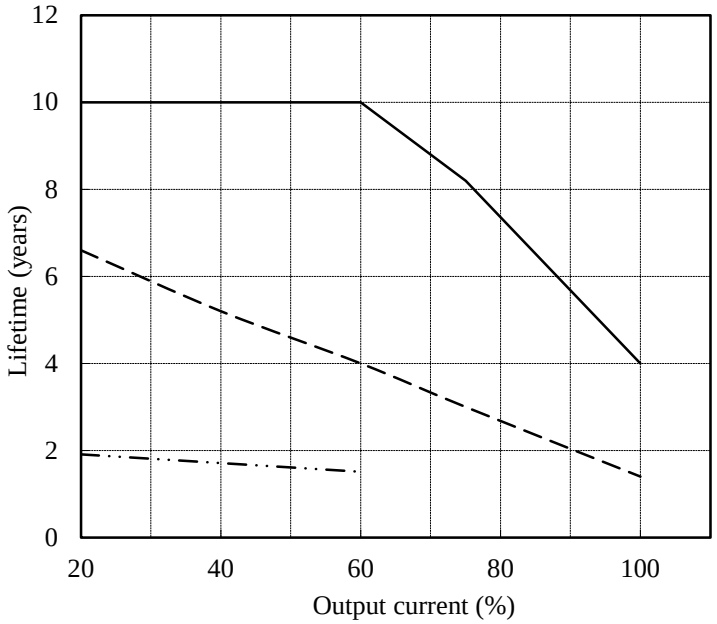
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 55℃	Ta= 71℃
20	10.0	6.5	2.0
40	10.0	5.1	1.7
60	10.0	4.0	1.5
75	8.1	2.9	-
100	3.9	1.3	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 55℃	Ta= 71℃
20	10.0	6.6	1.9
40	10.0	5.2	1.7
60	10.0	4.0	1.5
75	8.2	3.0	-
100	4.0	1.4	-



5. Abnormal Test

MODEL :DRL60-24-1

(1) Test Conditions

Input : 230VAC Output : 24V, 2.5A Ta : 25℃

(2) Test Results

(Da : Damaged)

No.	Test position		Test mode		Test result												
					a	b	c	d	e	f	g	h	i	j	k	l	
	Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P	O.C.P	No output	No change	Others	Note
1	D1	AC-AC	O							O	O			O			Da:F1
2		DC-DC	O							O	O			O			Da:F1
3		AC-DC	O							O	O			O			Da:F1
4		AC		O										O			
5		DC		O										O			
6	Q1	D-S	O							O	O			O			Da: F1,Z105,Q1
7		D-G	O							O	O			O			Da: F1,Z101
8		G-S	O											O			
9		D		O										O			
10		S		O										O			
11		G		O										O			
12	D51	A-K	O													O	Output hiccup
13		A(Pin1)		O											O		
14		A(Pin3)		O											O		
15		K		O										O			IC OFF
16	Q101	B-C	O												O		
17		C-E	O												O		
18		E-B	O												O		
19		B		O											O		
20		C		O											O		
21		E		O											O		
22	Q103	B-C	O												O		
23		C-E	O												O		
24		E-B	O													O	Output hiccup
25		B		O												O	Output hiccup
26		C		O												O	Output hiccup
27		E		O												O	Output hiccup
28	Q104	B-C	O												O		
29		C-E	O												O		
30		E-B	O												O		
31		B		O										O			
32		C		O										O			
33		E		O											O		

(Da : Damaged)

No.	Test position		Test mode		Test result												Note
					a	b	c	d	e	f	g	h	i	j	k	l	
	Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P	O.C.P	No output	No change	Others	
34	D101		O													O	Output hiccup
35				O											O		
36	D102		O												O		
37				O											O		
38	D103		O													O	Output hiccup
39				O												O	Output hiccup
40	D104		O												O		
41				O											O		
42	D105		O												O		
43				O											O		
44	D106		O												O		
45				O											O		
46	D107		O												O		
47				O											O		
48	D201		O												O		
49				O											O		
50	D202		O												O		
51				O											O		
52	Z101		O											O			
53				O											O		
54	Z102		O											O			
55				O												O	Output hiccup
56	Z103		O													O	Output hiccup
57				O											O		
58	Z104		O												O		OVP malfunction
59				O											O		
60	Z105		O											O			
61				O											O		
62	Z106		O											O			
63				O											O		
64	Z107		O											O			
65				O											O		Class 2 malfunction
66	Z109		O													O	IC OFF
67				O											O		
68	Z202		O									O		O			
69				O											O		OVP malfunction
70	Z203		O									O		O			
71				O											O		OVP malfunction

(Da : Damaged)

No.	Test position		Test mode		Test result												Note
					a	b	c	d	e	f	g	h	i	j	k	l	
	Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P	O.C.P	No output	No change	Others	
72	T1	1-2	O											O			
73		4-5	O							O	O						Da: F1,Z105,Z101,Q1
74		8-9	O													O	Output hiccup
75		1		O										O			
76		4		O										O			
77		8		O										O			
78	L51	1-2	O												O		
79		1,2		O											O		
80	L55	1-2	O										O				
81		3-4	O										O				
82		1-4	O												O		
83		2-3		O											O		
84	PC101	1-2	O									O		O			
85		3-4	O													O	Output hiccup
86		1,2		O								O		O			
87		3,4		O								O		O			
88	PC102	1-2	O												O		OVP malfunction
89		3-4	O									O		O			
90		1,2		O											O		OVP malfunction
91		3,4		O											O		OVP malfunction
92	A201	1-2	O													O	Output hiccup
93		2-3	O									O		O			
94		1		O								O		O			
95		2		O								O		O			
96		3		O								O		O			
97	C5	-	O											O			
98		-		O												O	Output hiccup
99	C51	-	O													O	Output hiccup
100		-		O											O		
101	C52	-	O													O	Output hiccup
102		-		O											O		
103	C54	-	O													O	Output hiccup
104		-		O											O		
105	C101	-	O													O	Output hiccup
106		-		O											O		
107	C203	-	O													O	Output hiccup
108		-		O											O		
109	C210	-	O													O	Output hiccup
110		-		O											O		
111	R104	-	O													O	Pin increase 0.1W
112		-		O											O		

(Da : Damaged)

No.	Test position		Test mode		Test result												Note
					a	b	c	d	e	f	g	h	i	j	k	l	
	Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P	O.C.P	No output	No change	Others	
113	A101	1-2	O												O		
114		2-3	O												O		
115		3-4	O											O			
116		4-5	O							O				O			Da: F1,Q1,Z105
117		5-6	O							O				O			Da: A101,F1,Q1,Z105
118		6-7	O											O			
119		7-8	O							O				O			Da: F1,Z105,Q1
120		9-10	O													O	Vout:30,Pin:83W
121		10-11	O											O			IC OFF
122		11-12	O												O		
123		12-13	O													O	Pin increase 6W
124		13-14	O												O		Vout=21.5V
125		14-15	O												O		
126		15-16	O													O	Output hiccup
127		3-1	O							O				O			Da:F1
128		3-5	O											O			
129		3-6	O												O		
130		3-7	O											O		O	trigger class 2 protection
131		3-8	O												O		OVP malfunction
132		3-9	O													O	Output hiccup
133		3-10	O											O			
134		3-11	O												O		
135		3-12	O												O		
136		3-13	O											O			
137		3-14	O											O			
138		3-15	O											O			
139		3-16	O											O			
140		1		O											O		Can't restart
141		2		O											O		
142		3		O										O			
143		4		O										O			
144		5		O												O	IC restart
145		6		O											O		
146		7		O										O			IC OFF
147		8		O											O		OVP malfunction
148		9		O										O			IC OFF
149		10		O											O		
150		11		O											O		
151		12		O											O		
152		13		O										O			
153		14		O											O		
154		15		O										O			
155		16		O										O			

6. Vibration Test

MODEL : DRL60-1

(1) Vibration Test Class

Frequency variable endurance test

(2) Equipment Used

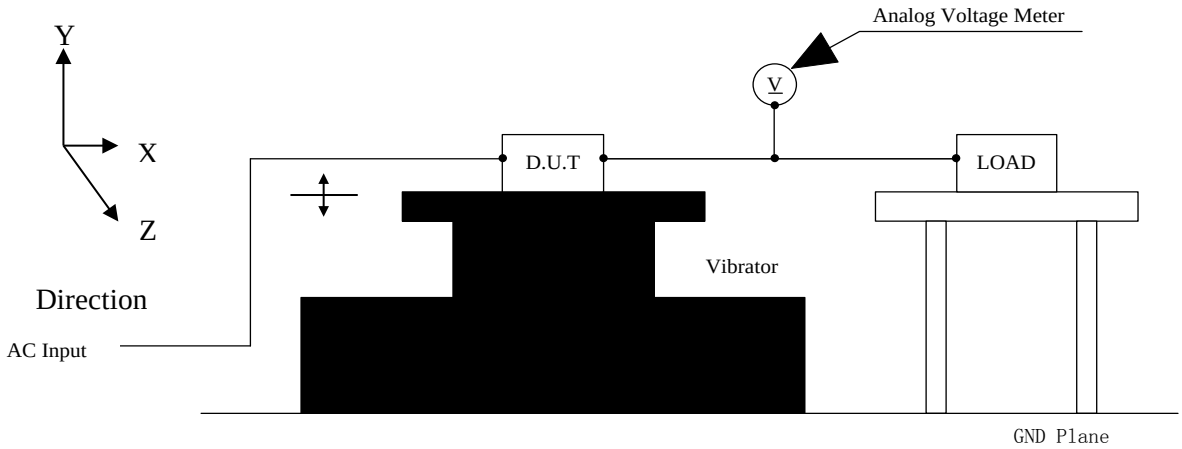
Controller	: ES-30-370 Suzhou Dongling	Vibrator	: ES-30-370 Suzhou Dongling

(3) Test Conditions

D.U.T is fixed on the DIN rail(TS-35) during the vibration test.

Test Spec	: IEC60068-2-6	D.U.T condition	: Operating
Sweep frequency	: 10～500Hz(sine wave)	Direction	: X, Y, Z
Sweep time	: 10.0min per cycle	Sweep count	: 1 hour each
Acceleration	: Constant 19.6m/s^2 (2G)		

(4) Test Method



(5) Judging Conditions

1. Output voltage not to exceed ±5% of initial value during test.
2. Not broken during test, sold pads no change by visual check after test.
3. Characteristic to be within regulation specification after the test.

(6) Test Results

OK

7. Shock Test

MODEL : DRL60-1

(1) Shock Test Class

Refer to IEC 60068-2-27, Half sine wave

(2) Equipment Used

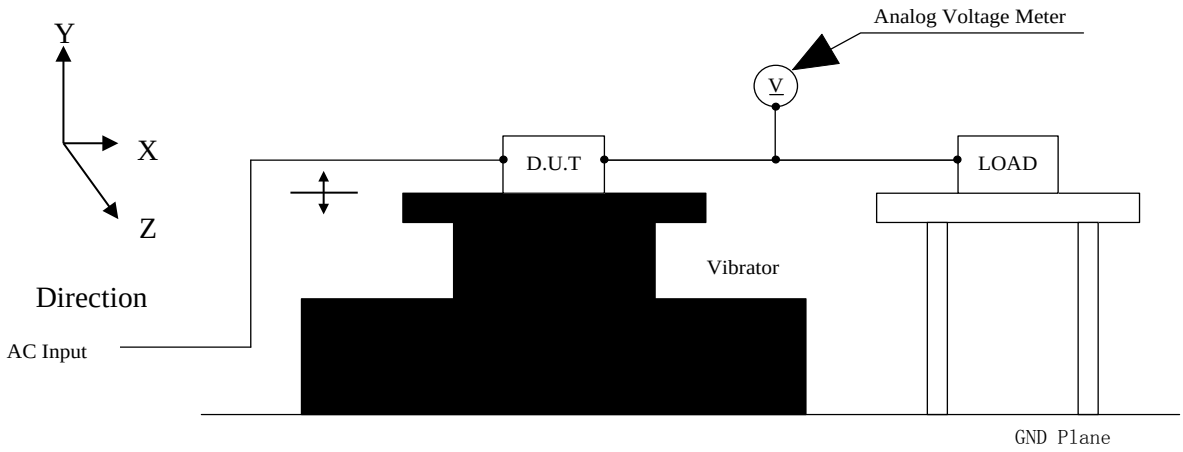
Controller	: ES-30-370 Suzhou Dongling	Vibrator	: ES-30-370 Suzhou Dongling

(3) Test Conditions

D.U.T is fixed on the DIN rail(TS-35) during the shock test.

Test Spec	: IEC60068-2-27	D.U.T condition	: Operating
Waveform	: Half sine wave	Direction	: X, Y, Z
Duration time	: 22ms	Shock times	: 3 shocks each
Acceleration	: Constant 39.2m/s^2 (4G)		

(4) Test Method



(5) Judging Conditions

1. Output voltage not to exceed ±5% of initial value during test.
2. Not broken during test, sold pads no change by visual check after test.
3. Characteristic to be within regulation specification after the test.

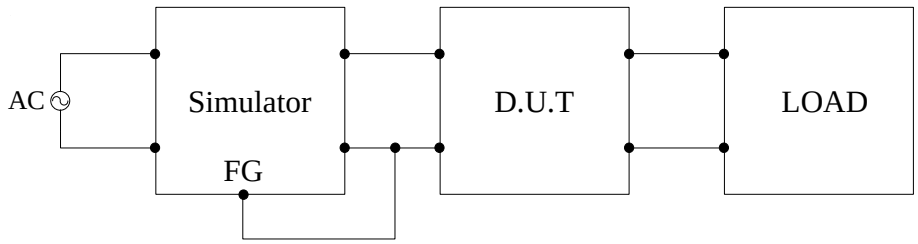
(6) Test Results

OK

8. Noise Simulate Test

MODEL：DRL60-1

(1) Test Circuit and Equipment



Simulator ：INS-400L （Noise Laboratory Co.,LTD）

(2) Test Conditions

Input voltage	: 115, 230VAC	Noise level	: 0～2kV
Output Voltage	: Rated	Phase	: 0～360 deg
Output current	: 0, 100%	Polarity	: ＋,－
Ambient temperature	: 25℃	Mode	: Normal
Pulse width	: 50～1000ns	Trigger select	: Line

(3) Judging Conditions

1. Output voltage not to exceed ±5% of initial value during test.
2. Not broken during test.

(4) Test Results

OK

9. Thermal Shock Test

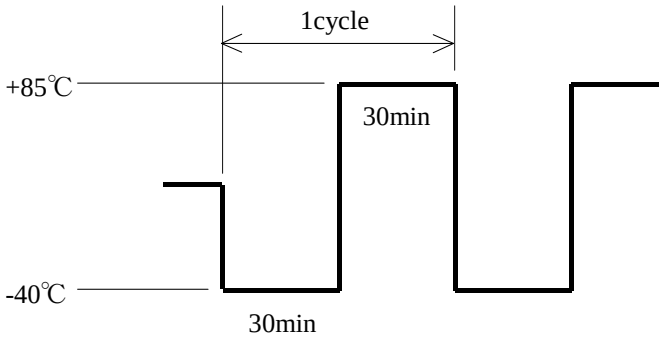
MODEL : DRL60-1

(1) Equipment Used

TSA-101S-W : ESPEC

(2) Test Conditions

Ambient Temperature : -40℃ ⇔ 85℃
Test Time : Refer to Dwg.
Test Cycle : 100 Cycles
Not Operating



(3) Test Method

Before testing, check if there is no abnormal output, then put the D.U.T. in testing chamber, and test it according to the above cycle. 100 cycles later, leave it for 1 hour at the room temperature , then check if there is no abnormal output.

(4) Judging Conditions

1. Not to be broken
2. Characteristic to be within regulation specification after the test.

(5) Test Results

OK

10. Voltage Dips, Short Interruptions Immunity Test (SEMI-F47)

MODEL : DRL60-1

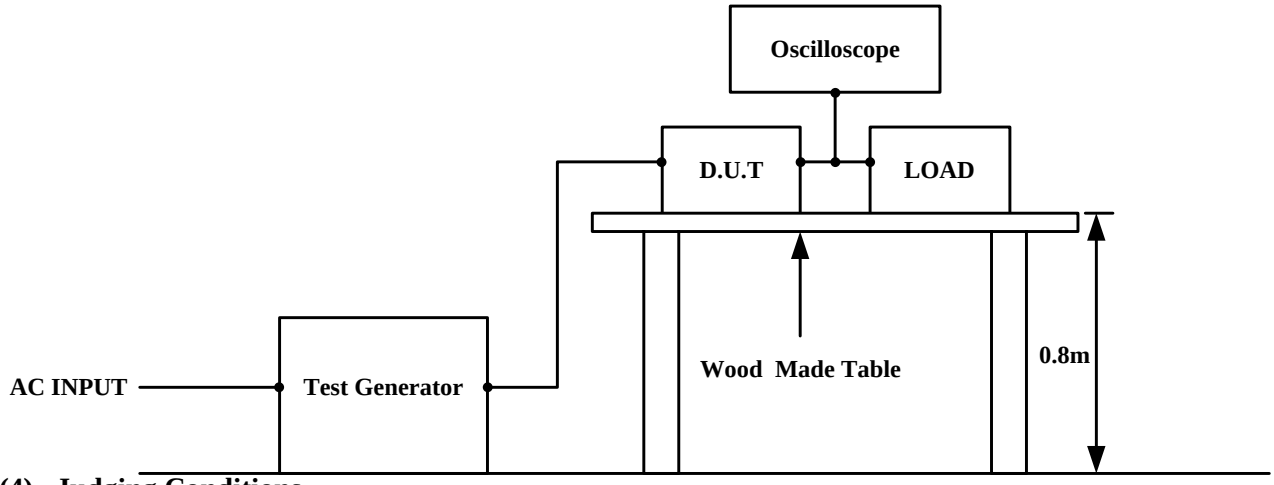
(1) Equipment Used

Test Generator : PCR2000L（KIKUSUI）

(2) Test Conditions

Input Voltage	: 200VAC	Output Voltage	: Rated
Output Current	: 100%	Ambient Temperature	: 25℃
Number of Tests	: 3 times	Test interval	: More than 10 seconds

(3) Test Method and Device Test Point



(4) Judging Conditions

1. Output voltage to be within output voltage regulation specification after the test.
2. Smoke and fire do not occur.

(5) Test Result

Test Level	Dip rate	Continue Time	DRL60-* -1
50%	50%	50~200ms	PASS
70%	30%	200~500ms	PASS
80%	20%	500~1000ms	PASS
50%	50%	1000ms	PASS